

# AUDIO RECORDINGS OF LECTURES AS AN E-LEARNING RESOURCE

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## Abstract

This paper is concerned with how technological and other changes have affected the advantages and disadvantages of making audio recordings of lectures available as a learning resource. Factors considered include the cost of producing such a resource and how it can be published to a web enabled, e-learning environment. Also discussed are possible changes to lecture delivery to maximise the usability of the audio recordings.

Student reaction to the audio files is investigated using student questionnaires. The questionnaires indicate that many students make significant use of audio resources and that this activity can play a valuable role in the learning process. However, an analysis of end-of-module examination performance showed no consistent relationship between audio file usage and examination performance.

In conclusion it is argued that publishing audio recordings of traditional lectures via a web-enabled, e-learning system offers a cost-effective way to enhance the educational experience of the learner.

**Keywords:** audio, e-learning, lectures, recording, resource.

## 1. Introduction

Advances in digital technology serve up new opportunities to the educator on what seems like a daily basis. The problem for the innovative teacher is how to recognise which opportunities are worth pursuing. The long-term success of any learning resource depends upon two factors:

- The resource must be of genuine value to the learner.
- The cost of producing and delivering the resource must be sustainable.

Here sustainable means that the enhancement to student learning must be large compared to the time, money and expertise required to produce and deliver the learning resource. What we are looking for is a high value-added ratio where the value-added ratio is defined as:

$$\text{Value-Added Ratio} = \frac{\text{Total Learning Enhancement}}{\text{Cost of Production and Delivery}}$$

Granted this is ‘fuzzy’ math, even the units are undetermined, but the author believes the concept is valid. The total learning enhancement is, of course, the learning enhancement per student multiplied by the number of students involved, where the number of students involved is a function of both how widely the resource is used and its longevity.

Many learning initiatives succeed locally because of the commitment, enthusiasm (and indeed charisma) of the teachers involved. Often these initiatives are backed by a grant to fund the initiative. Such projects are worthwhile and often show the way for future development, but many initiatives fail to gain widespread adoption because the value-added ratio is wrong. Arguably most university lectures are enthusiastic teachers who have a genuine desire to make their teaching more effective. However, we live in a climate where ever greater demands are made on the academic’s time. In particular, the explosion in university administration and the grinding pressure for more research publications can drain the will to live (never mind the will to improve teaching) from even the most energetic lecturer (Richards, J, 1997), (Martin 1999, pp6-24). On top of this, increased bureaucracy and a general lack of resources are further obstacles to be overcome before any new initiative can be launched.

Against such a backdrop it is obvious that for any learning initiative to enjoy long-term, wide-spread adoption it must provide a significant enhancement to learning for relatively little time,

money and effort on behalf of the teacher.

## **2. Why Now?**

Higher education in many countries is currently experiencing large disruptive forces from three directions. These forces are irrevocably changing the nature and role of universities. The first of these forces comes from the staggering growth in student numbers (Martin 1999, p6). The second force is due to changes in the way universities are funded and managed. These changes have reduced the modern university to an unhappy mongrel having the worst characteristics of a civil service department and a business; the days when a university could be regarded as a self-governing community of scholars are a long way behind us. The third disruptive force originates in the relentless and accelerating change in technology. Although feared by many, technological change offers the beleaguered university teacher a way to leverage both expertise and resources. If used properly, technology can help to alleviate the educational deficiency suffered by today's university students. The work described in this paper is a small example of how technology can be harnessed to improve the richness of the learning environment. Recent changes in digital electronics that have made the work viable include:

- Personal music players allow digital audio to be played anywhere, anytime.
- Consumer electronics make recording lectures cheap and easy.
- Audio-editing software makes post-processing recordings quick, easy and cheap.
- Modern content delivery systems such as Virtual Learning Environments (VLEs), Learning Management Systems (LMSs) and Podcasting make audio access easy for anyone with a web connection.
- Broadband connections make downloading audio files quick and easy.

In short, the cost of producing audio recordings of lectures is low in terms of both time and money, and the technical expertise required to do so is not high and is easily learned. At its simplest, an audio recording of a lecture can be made available, unedited, to students for a total cost in staff time of about ten minutes and for close to zero monetary cost.

## **3. Why Bother?**

Making audio recordings of lectures available to students offers advantages to both staff and students.

## **Advantages to staff**

### *Professional development*

Most lecturers will want to edit their lecture recordings. Some will just want to remove the extraneous noise recorded at the beginning and end of the lecture. Others, the author included, will want to ‘chunk-up’ the audio into segments that relate to the sections in the lecture notes. Consequently the lecturer is forced to hear what the class must have heard. This can be a salutary experience that shines a light on deficiencies in lecture delivery thereby pointing the way to improved lecturing technique.

### *Student engagement and failure rates*

Failure of students to engage with their studies and the consequent high non-completion rates are current problems in the UK university system. Audio recordings offer an additional way to access course content. This creates a more inclusive learning environment that should, in turn, improve student engagement. Higher levels of student engagement and access to audio recordings during assessment times might help to reduce overall failure rates.

### *Less ‘knocks on the door’*

Access to audio recordings offers students an alternative way to resolve problems. This might reduce the time spent on learning support or, ideally, free-up time to be spent on more complex issues.

## **Advantages to students**

### *When a lecture is missed*

Students miss lectures for a variety of reasons. It may be illness, a family crisis or perhaps a part-time job that clashes with one or more timetabled lectures. An audio recording of the lecture can help such students to keep up with the work of the class.

### *When English is not the student’s first language*

English is not the first language of many students studying at UK universities making it difficult to take in all that is said during a lecture. Audio recordings can be replayed as often as necessary until the lecture content is fully understood.

### *When baffled first time through*

It is difficult to take in new concepts and methods the first time they are presented. Audio recordings allow the material to be revisited as often as necessary to comprehend the new material (Zhang et al 2004).

#### *When listening to the lecture*

Biggs (2003, p117) states that during lectures students need to juggle two tasks:

‘comprehending the message, and recording its gist. Most can’t do this adequately ...’.

Knowing that an audio recording of the lecture will be made available after the event frees the student from having to fully take or annotate notes during the lecture. This allows students to concentrate on the material being presented and to participate in any discussion that takes place (knowing that the discussion will also be available on the audio recording)

#### *When attempting coursework, tutorial questions or doing revision*

The significance of what is said in a lecture may not become apparent until the student is asked to work with the material. Being able to refer to audio recordings will enhance student learning while doing coursework, tutorial questions or revising for an examination.

#### *When suffering from some special needs*

Some students with special needs might benefit from having access to audio recordings of lectures. For instance, students with minor hearing problems can replay the lecture at a volume suitable to them.

#### *When ‘out for a year’*

It is not unusual for the progression of some students to be held up until their performance in one or more modules improves. Such students are often part-time making access to audio recording of lectures particularly valuable.

#### *When learning to learn*

Developing the students’ ability to learn should be a principle objective of any university course. Real learning is taking place when the students solve their own problems. Audio recording of lectures offer students an opportunity to engage in independent learning.

## **4. The Downside!**

The previous section focused on the advantages of publishing audio recordings of traditional lectures; this section outlines the possible disadvantages.

### **More technology**

Modern teaching often involves a fair amount of technology and most university teachers have had to become reasonably competent AV technicians. To make an audio recording of a lecture inevitably involves yet more technology; this is not a good thing!

### **Staff time**

To produce audio recordings takes time, and time is in short supply. A little time is involved during the lecture and some time must be spent after the lecture to post-process the material. However, as suggested earlier, the time-cost can be as low as ten minutes per lecture for unedited audio. This is a small price to pay for the potential learning enhancements on offer.

### **Hardware costs**

Hardware costs are also involved, but again these can be low as there is a range of inexpensive hardware that can be used for recording including:

- 1 An MP3 player with built-in recording capability.
- 2 A digital voice recorder.
- 3 A Sony mini-disc player/recorder with an external microphone.
- 4 A microphone connected to a USB port on a laptop computer.

### **Software Costs**

Software costs relate to software to edit the audio. Fortunately there are a number of audio editing packages that can be downloaded for little or no cost (WavePad 2006), (Audacity, 2000). The capabilities of such packages are more than adequate for editing lecture recordings. Note that when discussing hardware and software costs it has been assumed that the means to distribute the audio files (shared network drive, VLE etc) is already in place.

### **Students will be encouraged to miss lectures**

The author subscribes to 'Theory Y' regarding human trustworthiness (McGregor 1960, Biggs 2003, p64). Theory Y subscribers believe that students should be trusted to take

responsibility for their own learning and that the educator's job is to support, rather than dictate to, the students. That being the case the author has no qualms over making lecture recordings available, trusting the students to make sensible use of them. If students find they can learn adequately without attending lectures then there is little, if any, point taking steps to enforce attendance. Having said that, the author's experience is that lecture attendance is largely unaffected by making recordings available. This is in accordance with the findings of a survey of staff taken after audio recordings were made available at the University of Western Australia (2006) which found that 30% of respondents thought lecture attendance was unaffected, 41% thought it increased and 25% thought it reduced by making recordings of lectures available over the web.

### **Changes to lecture delivery**

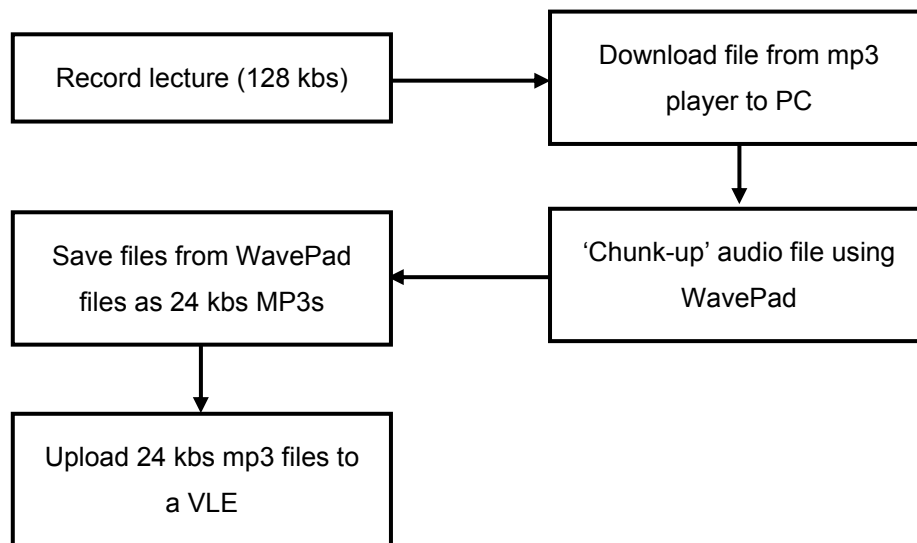
Ideally changes should be made to lecture technique and even small changes can significantly increase the usefulness of the audio recordings. At its simplest saying 'at the bottom of page three we see that ...' is a lot more useful to the listener than saying 'at the bottom of the page we see that ...'. Being aware of the future listener adds to the cognitive demand on the lecturer and this might adversely affect spontaneity and naturalness. The author's experience is that while this is a slight problem during the first few recordings it subsequently becomes a non-issue.

## **5. The Process Used**

The lectures discussed in this paper were on various aspects of structural mechanics. Prior to the start of the course a detailed lecture schedule and lecture notes were published. Typically about half of the lecture notes are devoted to covering the theory (including a number of fully worked examples of the application of the theory). The remaining pages contain additional exercises. Answers and sometimes skeleton solutions are given to the additional examples. The production of a portfolio of model solutions to the additional exercises is regarded as being the most important learning activity of the module. The students are expected to print out both the notes and the schedule and to turn up for lectures having read the relevant section of the notes. During the lecture the notes are projected on to a screen and lecture is used to give background information and to explain the more challenging parts of the notes. The straightforward parts of the notes are passed over very quickly. On occasions the lecture will break for discussion, or for the students to attempt a short piece of work or for the lecturer to

do some work on the board. Figure 1 outlines the process used to record the lectures.

FIGURE 1: An outline of the process used



There follows a brief outline of the steps involved.

- Record the lecture as a 128 kbs (kilobit per second) audio file. To date an iRiver (iFP-390T) mp3 recorder with a built-in microphone has been used. The recording rate is relatively high and this leads to big files. There is no real advantage in recording at lower bit-rate (and therefore lower quality) as the memory on the device (256MB) allows several hours of audio to be recorded before the device is full.
- The next step is to download the recorded files to a PC for processing. The recorder used comes with its own software to do this but note that many other devices are recognised as storage devices by Windows allowing the files on the device to be manipulated using Windows Explorer.
- Once the files have been downloaded to the PC they are edited in WavePad and then saved as 24 kbs mp3 files. This low bit-rate is adequate for voice recordings. The low bit-rate means that the final file sizes are relatively modest (a typical file is about 15 minutes long and occupies about 2.5MB).
- The final step is to publish the files. This could be as simple as copying the files to a network folder that is accessible by the students. If a virtual learning environment (or equivalent) is used to manage learning resources then that is where the audio files would naturally be published.

Once familiar with the process the author found that the time taken to process a 50 minute

lecture was in the range of 20-30 minutes.

## **6 Pull or Push?**

The process described in the preceding section is based on a pull model of delivery as the students are expected to 'pull' the audio files down from a server a la carte. By contrast, Podcasting is a push model for distributing audio content that may offer advantages in some situations. It is a technically more sophisticated, and therefore more complex, than the pull model (Peter Meng, 2005). Podcasting is likely to be particularly attractive when the audio files are essential to the teaching strategy adopted by the lecturer, rather than as an optional extra as discussed in this paper.

## 7. Student Reaction

Two on-line surveys were taken to gauge student reactions to audio recordings offered to students enrolled on two modules on structural mechanics. One module was taken by second year students and other by third year students. Repeated requests to the students to complete the questionnaire elicited a response rate of approximately 65% for each module. Each module had an end-module-exam that contributed about 60% towards the final mark for the module and Table 1 attempts to investigate if there is any clear correlation between the use of the audio files and examination performance.

	Year 2 Module		Year 3 Module	
	Number	Exam Average	Number	Exam Average
Enrolled	61	52%	46	57%
Responded	40	54%	29	55%
Responded/ listened	21	57%	16	51%
Responded/did not listen	18	51%	13	58%
Did not respond	21	48%	17	62%
Number of comments	30		18	

TABLE 1: Exam Performance

The first point to note from Table 1 is that, as expected, the audio files were not universally listened to. Only about 55% of the respondents listened to the audio files (37 out of 69).

The students who take time to complete the survey are a self-selecting group. Prior to conducting the survey it was thought that students completing the survey would be those more engaged with their studies. Consequently it was expected that these students would out-perform in the examination. This was true for the second year module where students who completed the survey had an examination average 6% higher than those who did not. This result is reversed, however, for the third year module where students who completed the survey scored on average 7% worse than students who did not.

Table 1 gives a similarly confused message regarding the benefits of listening to the audio. The second year students who completed the questionnaire and listened to the audio averaged

5% better than the whole class in the end-of-module examination, while the corresponding students in the third year module scored 6% worse. Of course what we cannot know is how well the students who listened to the audio would have performed had they not listened. It could be argued from the third year survey that the last thing a student should do is to listen to the audio!

The survey also threw up the following results:

- 40% of the students who did not listen to the audio files thought that they might help their studies but never got around to listening to them.
- On a four-point scale of *Unacceptably Poor* (1) to *Very Good* (4) the sound quality was judged to be *Good* (3).
- On a five-point scale of *Not Useful at All* (1) to *Extremely Useful* (5) the usefulness of the audio files was judged to be *Useful* (3).
- On a five-point scale of *Not At All Important* (1) to *Extremely Important* (5) the importance that audio files be ‘fresh’ was judged to be *Important* (3). (‘Fresh’ meaning recorded at the actual lecture rather than at some previous academic session.)

Table 1 also shows that the students who responded to the survey added a generous number of individual comments (48 comments from a total of 69 respondents). The comments were generally positive and an attempt to categorise the comments is presented in Table 2.

Number of positive comments	23
Number of negative comments	6
Number of neutral comments	12
Number mentioning technical problems	7

TABLE 2: Categorisation of Comments

Many respondents put considerable thought into their responses and their comments give a useful insight into the student reactions to the audio files. There follows a selection of comments which I think give the most insight. The comments presented are representative of the totality of comments and are given in their original form (complete with some very original spelling and grammar).

### Some positive comments

1 for the lectures that i listened to that i had also attended it was good because it triggered memory of the lecture which helped the understanding better than just looking at notes and wandering why you scribbled the random scribble next to that particular diagram. I did not use the audio files as much as i had planned but when i did i found them useful.

2 The audio files were particularly useful when looking through worked examples. Sometimes numbers seem to appear from nowhere, the files cleared queries up very well.

3 i found the audio files useful as it allowed me to listen and made extra notes on what was discussed at class at home. however i found out that it took a while to download.

4 I found them extremely useful and would be grateful if they were used again for structures modules. (Even if this is not the view of some people, i feel if it benefits a small majority it is worthwhile). I downloaded them and put them onto my ipod and listened to them while revising my notes. Sounds sad, but it helped. Thank you

5 Really good resource, helped revision massively

6 At first I thought it was a bit of a suicidal idea on your part. Giving us a "tape" of what was happening in class could have greatly reduced attendance esp for the less keen or more able students. But really we all know there is NO substitute for being in class (and awake). They have been of great use to me especially when revising or a topic I am unsure on. Knowing i can "go back" at any time is great. I can have my notes in front of me and go over the examples with you going through the example so to speak, with me anytime any place. THEY ARE GREAT KEEP IT UP ps. Also v useful when in back row of rm211. With the racket from building site you can't always be sure you are hearing everything! This way you can go over it all

7 I think the files have to be 'fresh' as during the lectures some of the work is done on the board, but if you've attended the lecture it is easier to picture in your mind and understand. I found the audio files very useful during studying as it's not all reading, which made it more interesting.

8 Sorry, Jim, for filling in just now. I remember I sent you an e-mail last term to let you know I find the audio files useful. But I don't find them useful only for Structures B. It would be a great idea to have them in generally for many courses - especially the difficult one. Thanks for the audio files, they are rally a great idea - as you know. Best Regards

### Some neutral comments

1 They were actually a really good idea although sometimes i wasn't 100% sure what

diagrams you were talking about it might be more helpful and reassuring to the students listening if figures were always mentioned i know its not really the main thing that pops into your mind when lecturing but just a mental note.

may be it was better to record them some other time, i mean other than during lectures, this would help more to give better explanation on files because its recorder and should cover all quations which a student has to ask.

2 I payed attention during the lectures and wrote notes on what you said so I felt that the audio files were of little or no use to me. If I was to have a question or need clarification on the notes from the lecture I would consider listening to the audio files. Although, I had everything important that you said written down. I also felt that some time was wasted by using all the "technological" devices, the time waiting for the computer to start up, setting up the recorder, wondering if the battery on the computer was going to fail, waiting for the projector to warm up, all were a little distracting to the lecture and took time away from learning the material.

#### Some negative comments

1 the live recording of lectures does limit the flexibility of the teaching style, in terms of questions and explanations during the recording. but overall this is not a big issue.

2 some of the files could have done with editing, time consuming possibly but one file i think had about 5 minutes of off topic information

3 after listening to the lectures i felt the audio files would make no difference as i found it hard to believe without the visual aspect of linking the audio to the material i would be lost

4 I couldn't see when I would need to use the files to be honest. I think good worked examples and tutorials are the best way to learn

5 i understood the work most of the time however if i encountered any problems i preferred to approach you in the tutorial classes or during your drop in hour

#### Some technical comments

1 The files were a bit big to download on a dial-up connection, perhaps streaming files would be easier.

2 I was only able to access the files whilst in the university, i tried a few times at home but wasn't able to get them working either directly or by saving them.

## **8. The Future**

The advantages of making audio recordings of lectures have been understood for a long time. Famous examples include Feynman's (2003) 'six easy pieces' lecture series delivered to Caltech freshman physicists between 1961 and 1963 (now available in book form and on CD-ROM). Technological advances now allow universities to offer audio and video recordings of lectures as a university service (University of Western Australia, 2006), (Purdue University, 2006). Lectures are recorded, edited and posted on the university VLE/LMS by audio-visual technicians with little or no input from staff. In another recent development The University of Michigan (2006) teamed up with Apple to make use of Apple's Podcasting technology to deliver recordings of lectures. Such initiatives raise many questions and a report by Peter Meng (2005) gives a good snapshot of the technical and cultural issues raised by evolving distribution technologies.

## **9. Conclusions**

Modern technology offers an easy and inexpensive way to make audio recordings of lectures available to students. A significant number of students find audio recording of lectures very useful, indicating that the time and effort spent producing audio resources is well justified. Rapid technological change is likely to mean that in the near future many institutions will make and publish audio/video recordings of lectures semi-automatically.

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